What is claimed is:

1. An inspection system for inspecting a mask to determine if the mask has at least one desired transparent area organized in a desired transparent pattern and at least one desired opaque area organized in a desired opaque pattern, the mask including at least one actual transparent area and at least one actual opaque area, the inspection system comprising:

a beamlet supply assembly that directs a shaped beamlet towards one of the actual areas of the mask, the shaped beamlet having a beamlet characteristic that corresponds to a desired characteristic of one of the desired areas.

2. The inspection system of claim 1 wherein the shaped beamlet has substantially the same cross-sectional size and shape as one of the desired areas.

3. The inspection system of claim 1 wherein the shaped beamlet has substantially the same cross-sectional size and shape as one of the desired opaque areas.

4. The inspection system of claim 1 wherein the shaped beamlet has substantially the same cross-sectional size and shape as one of the desired transparent areas.

5. The inspection system of claim 1 wherein the cross-sectional size and shape of the shaped beamlet is at least approximately fifty percent of the size and shape of one of the desired areas.

6. The inspection system of claim 1 wherein the beamlet supply assembly includes a source of electrons.

7. The inspection system of claim 1 further comprising a detector assembly that measures the magnitude of the signal that passes through at least a portion of the mask.

8. The inspection system of claim 7 wherein the magnitude of the signal of the beamlet at the mask is compared with the magnitude of the signal measured by the detector assembly to inspect the mask.

9. The inspection system of claim 1 further comprising a detector assembly that measures the magnitude of the signal that is reflected off of the mask.

10. The inspection system of claim 9 wherein the magnitude of the signal of the beamlet at the mask is compared with the magnitude of the signal measured by the detector assembly to inspect the mask.

11. The inspection system of claim 1 wherein the beamlet supply assembly directs a plurality of spaced apart, shaped beamlets substantially simultaneously towards the mask.

12. The inspection system of claim 11 wherein the beamlet supply assembly directs at least approximately ten spaced apart, shaped beamlets substantially simultaneously towards the mask.

13. The inspection system of claim 11 wherein the beamlet supply assembly directs at least approximately one hundred spaced apart, shaped beamlets substantially simultaneously towards the mask.

14. The inspection system of claim 11 wherein the beamlet supply assembly directs at least approximately one thousand spaced apart, shaped beamlets substantially simultaneously towards the mask.

15. The inspection system of claim 11 wherein the beamlet supply assembly directs at least approximately ten thousand spaced apart, shaped beamlets substantially simultaneously towards the mask.

16. The inspection system of claim 11 wherein the plurality of spaced apart beamlets are organized in a pattern that is substantially similar to at least a portion of one of the desired patterns.

17. The inspection system of claim 11 wherein the plurality of spaced apart beamlets are organized in a pattern that is substantially similar to at least a portion of the desired transparent pattern.

18. The inspection system of claim 11 wherein the plurality of spaced apart beamlets are organized in a pattern that is substantially similar to at least a portion of the desired opaque pattern.

19. The inspection system of claim 1 wherein the beamlet supply assembly includes a beamlet shaper that shapes the beamlet.

20. The inspection system of claim 19 wherein the beamlet shaper system of claim 19 wherein the beamlet supply assembly includes a beamlet blanker positioned between the beamlet shaper and the mask.

22. A mask inspected with the inspection system of claim 1.

23. An exposure apparatus that utilizes the mask of claim 22.

24. An object on which an image has been formed by the exposure apparatus of claim 23.

25. A semiconductor wafer on which an image has been formed by the exposure apparatus of claim 23.

26. An inspection system for inspecting a mask to determine if the mask has a plurality of desired transparent areas organized in a desired transparent pattern and a plurality of desired opaque areas organized in a desired opaque pattern, the mask including a plurality of actual transparent areas and a plurality of actual opaque areas, the inspection system comprising:

a beamlet supply assembly that directs a selectable plurality of spaced apart beamlets substantially simultaneously at the mask.

27. The inspection system of claim 26 wherein the beamlet supply assembly directs at least approximately ten spaced apart beamlets substantially simultaneously towards the mask.

28. The inspection system of claim 26 wherein the beamlet supply assembly directs at least approximately one hundred spaced apart beamlets substantially simultaneously towards the mask.

29. The inspection system of claim 26 wherein the beamlet supply assembly directs at least approximately one thousand spaced apart beamlets substantially simultaneously towards the mask.

30. The inspection system of claim 26 wherein the beamlet supply assembly directs at least approximately ten thousand spaced apart beamlets substantially simultaneously towards the mask.

31. The inspection system of claim 26 wherein the plurality of spaced apart beamlets are organized in a pattern that is substantially similar to one of the desired patterns.

32. The inspection system of claim 26 wherein the plurality of spaced apart beamlets are organized in a pattern that is substantially similar to at least a portion of the desired transparent pattern.

33. The inspection system of claim 26 wherein the plurality of spaced apart beamlets are organized in a pattern that is substantially similar to at least a portion of the desired opaque pattern.

34. The inspection system of claim 26 wherein at least one of the beamlets is a shaped beamlet and has a beamlet characteristic that corresponds to a desired characteristic of one of the desired areas.

35. The inspection system of claim 34 wherein the shaped beamlet has substantially the same cross-sectional size and shape as one of the desired areas.

36. The inspection system of claim 34 wherein the shaped beamlet has substantially the same cross-sectional size and shape as one of the desired opaque areas.

37. The inspection system of claim 34 wherein the shaped beamlet has substantially the same cross-sectional size and shape as one of the desired transparent areas.

38. The inspection system of claim 26 further comprising a detector assembly that measures the magnitude of the signal that passes through at least a portion of the mask.

39. The inspection system of claim 38 wherein the calculated magnitude of the signal of the beamlet at the mask is compared with the magnitude of the signal measured by the detector assembly to inspect the mask.

40. The inspection system of claim 26 further comprising a detector assembly that measures the magnitude of the signal that is reflected off of the mask.

41. The inspection system of claim 40 wherein the calculated magnitude of the signal of the beamlet at the mask is compared with the magnitude of the signal measured by the detector assembly to inspect the mask.

42. The inspection system of claim 26 wherein the beamlet supply assembly includes a beamlet shaper that shapes the beamlets.

43. The inspection system of claim 42 wherein the beamlet shaper includes a first multiple aperture array having apertures with a first shape and a second multiple aperture array having apertures with a second shape.

44. The inspection system of claim 42 wherein the beamlet supply assembly includes a beamlet blanker positioned between the beamlet shaper and the mask.

45. A mask inspected with the inspection system of claim 26.

46. An exposure apparatus that utilizes the mask of claim 45.

47. An object on which an image has been formed by the exposure apparatus of claim 46.

48. A semiconductor wafer on which an image has been formed by the exposure apparatus of claim 46.

49. An inspection system for inspecting a mask, the inspection system comprising:

a source of electrons;

a stage supporting the mask;

a beamlet shaping section disposed between the source of electrons and the mask, the beamlet shaping section including a first multi-aperture array having apertures with a first shape and a second multi-aperture array having apertures with a second shape;

a beamlet blanking section disposed between the beamlet shaping section and the mask;

a first electron lens group directing electrons emitted from the source of electrons into a collimated beam in an axial direction towards the first multi-aperture array;

a second electron lens group directing each beamlet in the array of electron beamlets formed by the first multi-aperture array towards the center of a corresponding aperture in the second multi-aperture array;

an electron deflector disposed between the first multi-aperture array and the second multi-aperture array; and

a detector assembly that measures electrons to inspect the mask.

50. The inspection system of claim 49 wherein the beamlet blanking section comprises an active blanking aperture array having a plurality of apertures.

51. The inspection system of claim 50 wherein further comprising:

a third electron lens group to direct each beamlet in the array of beamlets having the selected shape towards a corresponding aperture in the active blanking aperture array;

a logic circuit associated with each aperture in the active blanking aperture array to deflect selected electron beamlets passing through the active blanking aperture array;

a contrast aperture to absorb the selected electrons beamlets deflected by the active blanking aperture array and to absorb x-rays generated by electrons striking surfaces in the electron-beam lithography system; and

a fourth electron lens group to focus the electron beamlets passing undeflected through the active blanking aperture array onto the mask.

52. The inspection system of claim 51 further comprising first active blanking aperture array shield having M rows and N columns of apertures corresponding to the apertures in the active blanking aperture array and wherein the first active blanking aperture array shield is disposed between the second multi-aperture array and the active blanking aperture array.

53. The inspection system of claim 52 wherein the first active blanking aperture array shield comprises a layer of a low atomic number material and a layer of a high atomic number material.

54. The inspection system of claim 53 further comprising a second active blanking aperture array shield having M rows and N columns of apertures corresponding to the apertures in the active blanking aperture array and wherein the second active blanking aperture array shield is disposed between the active blanking aperture array and the object to be exposed.

55. The inspection system of claim 54 wherein the second active blanking aperture array shield comprises a layer of a low atomic number material and a layer of a high atomic number material.

56. The inspection system of claim 55 wherein the system further comprising a first multi-aperture array shield having M rows and N columns corresponding to the apertures in the first multi-aperture array and wherein the first multi-aperture array shield is disposed between the source of electrons and the first multi-aperture array.

57. The inspection system of claim 56 wherein the first multi-aperture array shield comprises a layer of a low atomic number material and a layer of a high atomic number material.

58. The inspection system of claim 57 further comprising a second multi-aperture array shield having m rows and n columns corresponding to the apertures in the second multi-aperture array and wherein the second multi-aperture array shield is disposed between the first multi-aperture array and the second multi-aperture array.

59. The inspection system of claim 58 wherein the second multi-aperture array shield comprises a layer of a low atomic number material and a layer of a high atomic number material.

60. The inspection system of claim 59 further comprising at least one x-ray baffle.

61. The inspection system of claim 60 wherein the at least one x-ray baffle is disposed between the second multi-aperture array and the active blanking aperture array.

62. The inspection system of claim 61 wherein the fourth electron lens group comprises:

a first symmetric magnetic doublet disposed between the active blanking aperture array and the surface to be exposed; and

a second symmetric magnet doublet disposed between the first symmetric magnetic doublet and the object to be exposed.

63. The inspection system of claim 62 further comprising a deflection system disposed in the second symmetric magnetic doublet to deflect each electron beamlet onto a portion of the mask.

64. The inspection system of claim 63 further comprising a control unit coupled to:

the electron deflector;

each logic circuit associated with each aperture in the active blanking aperture array;

the deflector system; and

the stage.

65. The inspection system of claim 64 wherein a contrast aperture is disposed at a crossover point of the first symmetric magnetic doublet.

66. The inspection system of claim 65 wherein the logic circuit associated with each aperture includes a memory unit to store a next pattern logic.

67. The inspection system of claim 49 wherein the source of electrons comprises an electron gun.

68. The inspection system of claim 49 wherein the source of electrons comprises an array of individual electron sources that produce an array of electron beamlets having M rows and N columns that correspond to the apertures of the first multi-blanking aperture array.

69. The inspection system of claim 49 wherein the detector assembly measures the magnitude of the signal that passes through at least a portion of the mask.

70. The inspection system of claim 69 wherein the magnitude of the signal at the mask is compared with the magnitude of the signal measured by the detector assembly to inspect the mask.

71. The inspection system of claim 69 wherein the detector assembly measures the magnitude of the signal that is reflected off of the mask.

72. The inspection system of claim 71 wherein the magnitude of the signal at the mask is compared with the magnitude of the signal measured by the detector assembly to inspect the mask.

73. A mask inspected with the inspection system of claim 49.

74. An exposure apparatus that utilizes the mask of claim 73.

75. An object on which an image has been formed by the exposure apparatus of claim 74.

76. A semiconductor wafer on which an image has been formed by the exposure apparatus of claim 74.

77. A method for inspecting a mask to determine if the mask has at least one desired transparent area organized in a desired transparent pattern and at least one desired opaque area organized in a desired opaque pattern, the mask including at least one actual transparent area and at least one actual opaque area, the method comprising the step of:

directing a shaped beamlet from a beamlet supply assembly towards one of the actual areas of the mask, the shaped beamlet having a beamlet characteristic that corresponds to a desired characteristic of one of the desired areas.

78. The method of claim 77 wherein the step of directing a shaped beamlet includes the step of directing a shaped beamlet having substantially the same cross-sectional size and shape as one of the desired areas.

79. The method of claim 77 wherein the step of directing a shaped beamlet includes the step of directing a shaped beamlet having substantially the same cross-sectional size and shape as one of the desired opaque areas.

80. The method of claim 77 wherein the step of directing a shaped beamlet includes the step of directing a shaped beamlet having substantially the same cross-sectional size and shape as one of the desired transparent areas.

81. The method of claim 77 wherein the step of directing a shaped beamlet includes the step of directing a shaped beamlet having a cross-sectional size and shape that is at least approximately ninety percent of the size and shape of one of the desired areas.

82. The method of claim 77 wherein the step of directing a shaped beamlet includes the step of providing a beamlet supply assembly having a source of electrons.

83. The method of claim 77 further comprising the step of measuring the magnitude of the signal that passes through at least a portion of the mask with a detector assembly.

84. The method of claim 77 further comprising the step of measuring the magnitude of the signal that passes through at least a portion of the mask with a detector assembly and comparing the signal measured by the detector assembly to the magnitude of the signal of the beamlet at the mask.

85. The method of claim 77 further comprising the step of measuring the magnitude of the signal that is reflected off of the mask with a detector assembly.

86. The method of claim 77 further comprising the step of measuring the magnitude of the signal that is reflected off of the mask with a detector assembly and comparing the signal measured by the detector assembly to the magnitude of the signal of the beamlet at the mask.

87. The method of claim 77 wherein the step of directing a shaped beamlet includes the step of providing a beamlet supply assembly that directs a plurality of spaced apart beamlets simultaneously towards the mask.

88. The method of claim 77 wherein the step of directing a shaped beamlet includes the step of providing a beamlet supply assembly that directs at least approximately ten spaced apart beamlets substantially simultaneously towards the mask.

89. The method of claim 77 wherein the step of directing a shaped beamlet includes the step of providing a beamlet supply assembly that directs at least approximately one hundred spaced apart beamlets substantially simultaneously towards the mask.

90. The method of claim 77 wherein the step of directing a shaped beamlet includes the step of providing a beamlet supply assembly that directs at least approximately one thousand spaced apart beamlets substantially simultaneously towards the mask.

91. The method of claim 77 wherein the step of directing a shaped beamlet includes the step of providing a beamlet supply assembly that directs at least approximately ten thousand spaced apart beamlets substantially simultaneously towards the mask.

92. The method of claim 77 wherein the step of directing a shaped beamlet includes the step of directing a plurality of spaced apart beamlets at the mask, the beamlets being organized in a pattern that is substantially similar to at least a portion of one of the desired patterns.

93. The method of claim 77 wherein the step of directing a shaped beamlet includes the step of directing a plurality of spaced apart beamlets at the mask, the beamlets being organized in a pattern that is substantially similar to at least a portion of the desired transparent pattern.

94. The method of claim 77 wherein the step of directing a shaped beamlet includes the step of directing a plurality of spaced apart beamlets at the mask, the beamlets being organized in a pattern that is substantially similar to at least a portion of the desired opaque pattern.

95. The method of claim 77 wherein the step of directing a shaped beamlet includes the step of providing a beamlet shaper that shapes the beamlet.

96. The method of claim 95 wherein the step of providing a beamlet shaper includes the step of providing a first multiple aperture array having apertures with a first shape and providing a second multiple aperture array having apertures with a second shape.

97. The method of claim 96 wherein the step of directing a shaped beamlet includes the step of providing a beamlet blanker positioned between the beamlet shaper and the mask.

98. A method for manufacturing a mask, the method including the step of providing a mask and the step of inspecting the mask with the method of claim 77.

99. A method for making an exposure apparatus that forms an image on a wafer, the method comprising the steps of:

providing an irradiation apparatus that irradiates the wafer with radiation to form the image on the wafer; and

providing a mask made by the method of claim 98.

100. A method of making a wafer utilizing the exposure apparatus made by the method of claim 99.

101. A method of making an object including at least the exposure process; wherein the exposure process utilizes the exposure apparatus made by the method of claim 99.

102. A method for inspecting a mask to determine if the mask has a plurality of desired transparent areas organized in a desired transparent pattern and a plurality of desired opaque areas organized in a desired opaque pattern, the mask including a plurality of actual transparent areas and a plurality of actual opaque areas, the method comprising the step of:

directing a plurality of spaced apart, selectable beamlets from a beamlet supply assembly substantially simultaneously at the mask.

103. The method of claim 102 wherein the step of directing a plurality of spaced apart beamlets includes the step of directing at least approximately ten spaced apart beamlets simultaneously towards the mask.

104. The method of claim 102 wherein the step of directing a plurality of spaced apart beamlets includes the step of directing at least approximately one hundred spaced apart beamlets simultaneously towards the mask.

105. The method of claim 102 wherein the step of directing a plurality of spaced apart beamlets includes the step of directing at least approximately one thousand spaced apart beamlets simultaneously towards the mask.

106. The method of claim 102 wherein the step of directing a plurality of spaced apart beamlets includes the step of directing at least approximately ten thousand spaced apart beamlets simultaneously towards the mask.

107. The method of claim 102 wherein the step of directing a plurality of spaced apart beamlets includes the step of organizing the beamlets in a pattern that is substantially similar to at least a portion of one of the desired patterns.

108. The method of claim 102 wherein the step of directing a plurality of spaced apart beamlets includes the step of organizing the beamlets in a pattern that is substantially similar to at least a portion of the desired transparent pattern.

109. The method of claim 102 wherein the step of directing a plurality of spaced apart beamlets includes the step of organizing the beamlets in a pattern that is substantially similar to at least a portion of the desired opaque pattern.

110. The method of claim 102 wherein the step of directing a plurality of beamlets includes the step of directing a shaped beamlet having substantially the same cross-sectional size and shape as one of the desired areas.

111. The method of claim 102 wherein the step of directing a plurality of beamlets includes the step of directing a shaped beamlet having substantially the same cross-sectional size and shape as one of the desired opaque areas.

112. The method of claim 102 wherein the step of directing a plurality of beamlets includes the step of directing a shaped beamlet having substantially the same cross-sectional size and shape as one of the desired transparent areas.

113. The method of claim 102 further comprising the step of measuring the magnitude of the signal that passes through at least a portion of the mask with a detector assembly.

114. The method of claim 102 further comprising the step of measuring the magnitude of the signal that passes through at least a portion of the mask with a detector assembly and comparing the signal measured by the detector assembly to the magnitude of the signal of the beamlet at the mask.

115. The method of claim 102 further comprising the step of measuring the magnitude of the signal that is reflected off of the mask with a detector assembly.

116. The method of claim 102 further comprising the step of measuring the magnitude of the signal that is reflected off of the mask with a detector assembly and comparing the signal measured by the detector assembly to the magnitude of the signal of the beamlet at the mask.

117. The method of claim 102 wherein the step of directing a plurality of beamlets includes the step of providing a beamlet shaper that shapes the beamlets.

118. The method of claim 117 wherein the step of providing a beamlet shaper includes the step of providing a first multiple aperture array having apertures with a first shape and providing a second multiple aperture array having apertures with a second shape.

119. The method of claim 117 wherein the step of directing a shaped beamlet includes the step of providing a beamlet blanker positioned between the beamlet shaper and the mask.

120. A method for manufacturing a mask, the method including the step of providing a mask and the step of inspecting the mask with the method of claim 102.

121. A method for making an exposure apparatus that forms an image on a wafer, the method comprising the steps of:

providing an irradiation apparatus that irradiates the wafer with radiation to form the image on the wafer; and

providing a mask made by the method of claim 120.

122. A method of making a wafer utilizing the exposure apparatus made by the method of claim 121.

123. A method of making an object including at least the exposure process; wherein the exposure process utilizes the exposure apparatus made by the method of claim 121.

124. A method for inspecting a device with electrons, the method comprising the steps of:

generating electrons;

directing the electrons in a collimated beam in an axial direction towards the device;

directing the collimated beam of electrons through a beamlet shaping section comprising a first multi-aperture array having M rows and N columns of apertures having a first shape, a second multi-aperture array having M rows and N columns of apertures having a second shape;

directing the electrons emerging from the beamlet shaping section through a beamlet blanking section;

directing electron beamlets having the first shape formed by the first multi-aperture array towards the center of corresponding apertures in the second multi-aperture array;

deflecting each of the electron beamlets formed by the first multi-aperture array away from the center of the corresponding aperture in the second multi-aperture array; and

measuring electrons with a detector assembly to inspect the device.

125. The method of claim 124 wherein directing the electrons through a beamlet blanking section comprises directing the electrons through an active blanking aperture array having M rows and N columns of apertures.

126. The method of claim 125 wherein the method further comprises:

directing each electron beamlet in the array of electron beamlets having the selected shape towards a corresponding aperture in the active blanking aperture array;

deflecting selected electron beamlets passing through the active blanking aperture array with logic circuits associated with each aperture in the active blanking aperture array;

absorbing the selected electrons beamlets deflected by the active blanking aperture array with a contrast aperture; and

focusing the electron beamlets passing undeflected through the active blanking aperture array onto the device.

127. The method of claim 126 wherein the method further comprises directing the electron beamlets having the selected shape through a first active blanking aperture array shield having M rows and N columns of apertures corresponding to the apertures in the active blanking aperture array and wherein the first active blanking aperture array shield is disposed between the second multi-aperture array and the active blanking aperture array.

128. The method of claim 127 wherein directing the electron beamlets having the selected shape through a first active blanking aperture array shield comprises directing the electron beamlets through a first active blanking aperture array shield comprising a layer of a low atomic number material and a layer of a high atomic number material.

129. The method of claim 128 wherein the method further comprises directing the electron beamlets having the selected shape through a second active blanking aperture array shield having M rows and N columns of apertures corresponding to the apertures in the active blanking aperture array and wherein the second active blanking aperture array shield is disposed between the active blanking aperture array and the device.

130. The method of claim 129 wherein directing the electron beamlets having the selected shape through a second active blanking aperture array shield comprises directing the electron beamlets through a second active blanking aperture array shield comprising a layer of a low atomic number material and a layer of a high atomic number material.

131. The method of claim 130 wherein the method further comprises directing the electron beamlets through a first multi-aperture array shield having M rows and N columns corresponding to the apertures in the first multi-aperture array and wherein the first multi-aperture array shield is disposed between the source of electrons and the first multi-aperture array.

132. The method of claim 131 wherein directing the electron beamlets through a first multi-aperture array shield comprises directing the electron beamlets through a first multi-aperture array shield comprising a layer of a low atomic number material and a layer of a high atomic number material.

133. The method of claim 132 wherein the method further comprises directing the electron beamlets through a second multi-aperture array shield having M rows and N columns corresponding to the apertures in the second multi-aperture array and wherein the second multi-aperture array shield is disposed between the first multi-aperture array and the second multi-aperture array.

134. The method of claim 133 wherein directing the electron beamlets through a second multi-aperture array shield comprises directing the electron beamlets through a second multi-aperture array shield comprising a layer of a low atomic number material and a layer of a high atomic number material.

135. The method of claim 134 wherein the method further comprises directing the electron beamlets through at least one x-ray baffle.

136. The method of claim 135 wherein directing the electron beamlets through at least one x-ray baffle comprises directing the electron beamlets through at least one x-ray baffle disposed between the second multi-aperture array and the active blanking aperture array.

137. The method of claim 136 wherein the method further comprises:

directing the electron beamlets through a first symmetric magnetic doublet disposed between the active blanking aperture array and the device; and

directing the electron beamlets through a second symmetric magnetic doublet disposed between the first symmetric magnetic doublet and the device.

138. The method of claim 137 wherein the method further comprises directing the electron beamlets through a deflection system disposed in the second symmetric magnetic doublet.

139. The method of claim 138 wherein the method further comprises controlling the electron deflector, each logic circuit associated with each aperture in the active blanking aperture array, the deflecting, and movement of a stage which supports the device with a control unit.

140. A method for manufacturing a device, the method including the step of providing a mask and the step of inspecting the mask with the method of claim 124.

141. A method for making an exposure apparatus that forms an image on a wafer, the method comprising the steps of:

providing an irradiation apparatus that irradiates the wafer with radiation to form the image on the wafer; and

providing a device made by the method of claim 140.

142. A method of making a wafer utilizing the exposure apparatus made by the method of claim 141.

143. A method of making an object including at least the exposure process; wherein the exposure process utilizes the exposure apparatus made by the method of claim 141.